FIG. 1

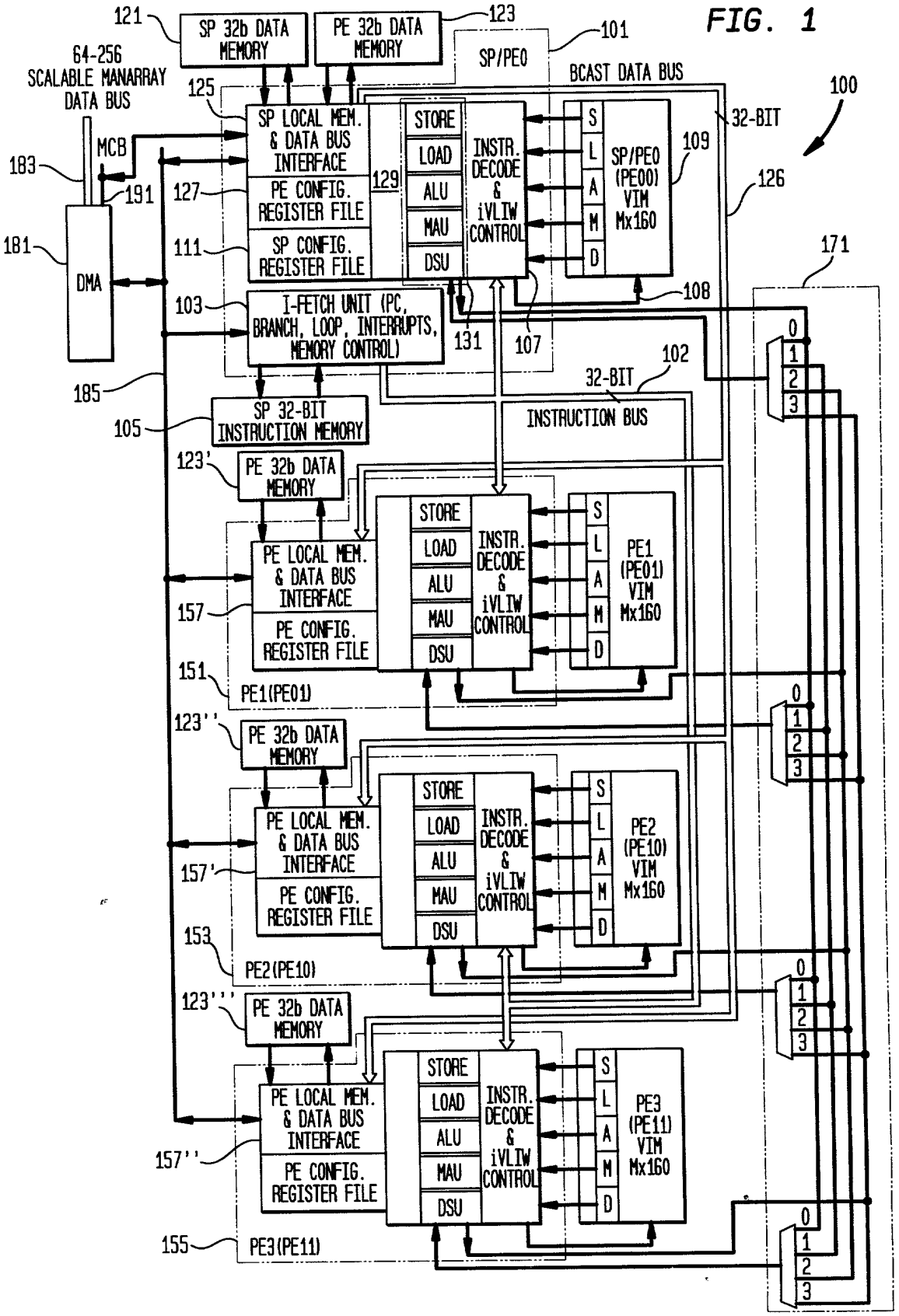
121
SP 32b DATA MEMORY
123
PE 32b DATA MEMORY
101
SP/PE0
64-256 SCALABLE MANARRAY DATA BUS
BCAST DATA BUS
100
125
SP LOCAL MEM. & DATA BUS INTERFACE
STORE
LOAD
ALU
MAU
DSU
INSTR. DECODE & iVLIW CONTROL
S
L
A
M
D
SP/PE0 (PE00) VIM Mx160
109
32-BIT
126
183
MCB
191
127
PE CONFIG. REGISTER FILE
129
181
DMA
111
SP CONFIG. REGISTER FILE
171
103
I-FETCH UNIT (PC, BRANCH, LOOP, INTERRUPTS, MEMORY CONTROL)
131
107
108
102
32-BIT
INSTRUCTION BUS
185
105
SP 32-BIT INSTRUCTION MEMORY
123'
PE 32b DATA MEMORY
PE LOCAL MEM. & DATA BUS INTERFACE
157
PE CONFIG. REGISTER FILE
PE1 (PE01) VIM Mx160
151
PE1(PE01)
123''
PE 32b DATA MEMORY
PE LOCAL MEM. & DATA BUS INTERFACE
157'
PE CONFIG. REGISTER FILE
PE2 (PE10) VIM Mx160
153
PE2(PE10)
123'''
PE 32b DATA MEMORY
PE LOCAL MEM. & DATA BUS INTERFACE
157''
PE CONFIG. REGISTER FILE
PE3 (PE11) VIM Mx160
155
PE3(PE11)
0
1
2
3

*FIG. 2C*

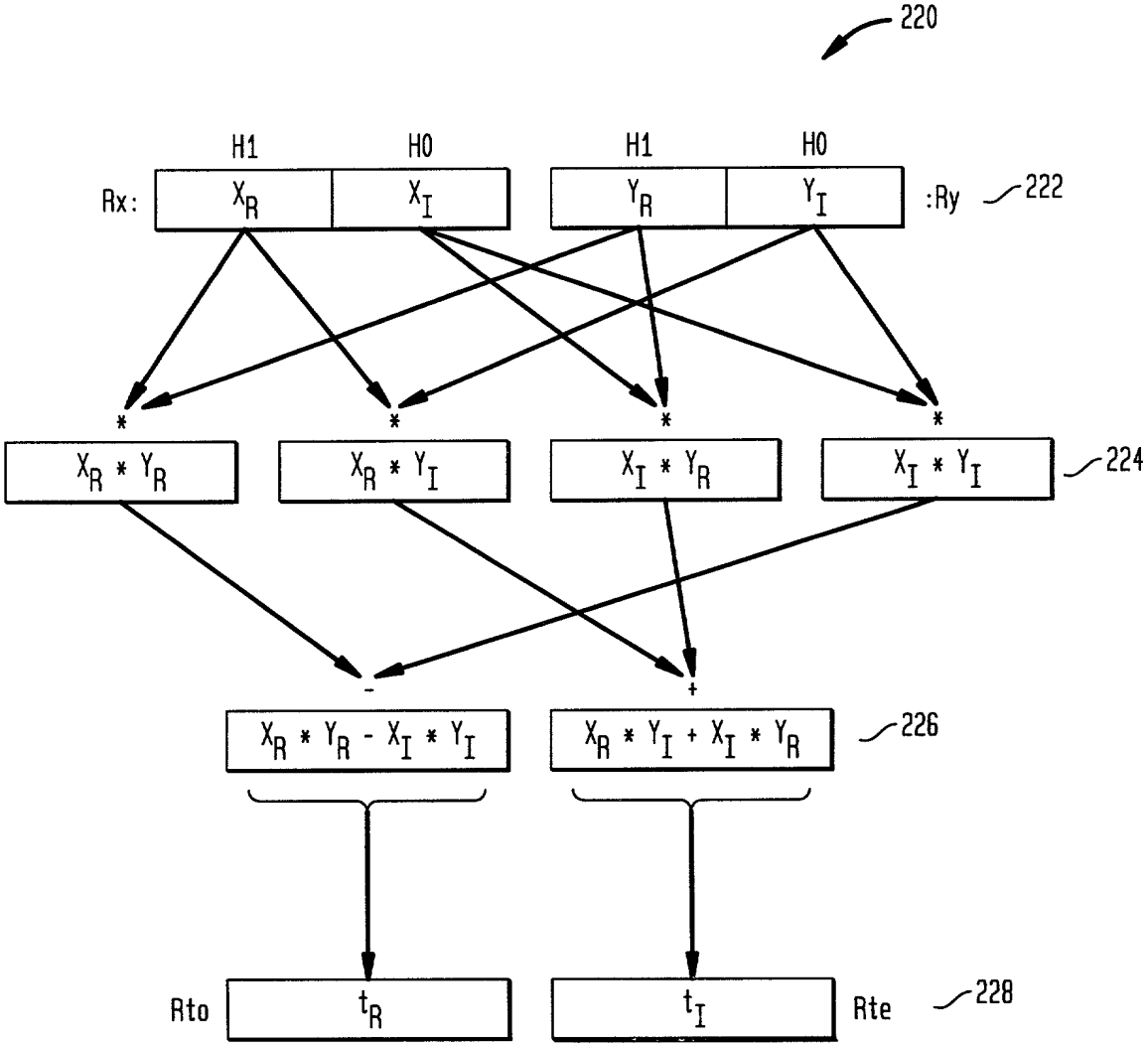
220
H1
H0
H1
H0
Rx:
$X_R$
$X_I$
$Y_R$
$Y_I$
:Ry
222
*
*
*
*
$X_R * Y_R$
$X_R * Y_I$
$X_I * Y_R$
$X_I * Y_I$
224
-
+
$X_R * Y_R - X_I * Y_I$
$X_R * Y_I + X_I * Y_R$
226
Rto
$t_R$
$t_I$
Rte
228

FIG. 3A

300

ENCODING

| 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GROUP | | S/P | UNIT | | MAUopcode | | | | | | Rte | | | | 0 | Rx | | | | | Ry | | | | | CE3 | | ME | | | | |

FIG. 3B

310

SYNTAX/OPERATION

| INSTRUCTION | OPERANDS | OPERATION | ACF |
|---|---|---|---|
| | | | DUAL HALFWORDS |
| MPYCXJL.[SP]M.2SH | Rte, Rx, Ry | DO OPERATION BELOW BUT DO NOT AFFECT ACFs | NONE |
| MPYCXJL.[NVZ].[SP]M.2SH | Rte, Rx, Ry | Rto←(Rx.H1*Ry.H1+Rx.H0*Ry.H0)<br>Rte←(Rx.H0*Ry.H1-Rx.H1*Ry.H0) | F1<br>F0 |
| [TF].MPYCXJL.[SP]M.2SH | Rte, Rx, Ry | DO OPERATION ONLY IF T/F CONDITION IS SATISFIED IN ACFs | NONE |

ARITHMETIC SCALAR FLAGS AFFECTED (ON THE LEAST SIGNIFICANT OPERAND (Rte) OR AS SPECIFIED)
C = NOT AFFECTED
N = MSB OF RESULT
V = 1 IF AN INTEGER OVERFLOW OCCURS ON EITHER RESULT, 0 OTHERWISE
Z = 1 IF A ZERO RESULT IS GENERATED, 0 OTHERWISE
CYCLES: 2

FIG. 3C

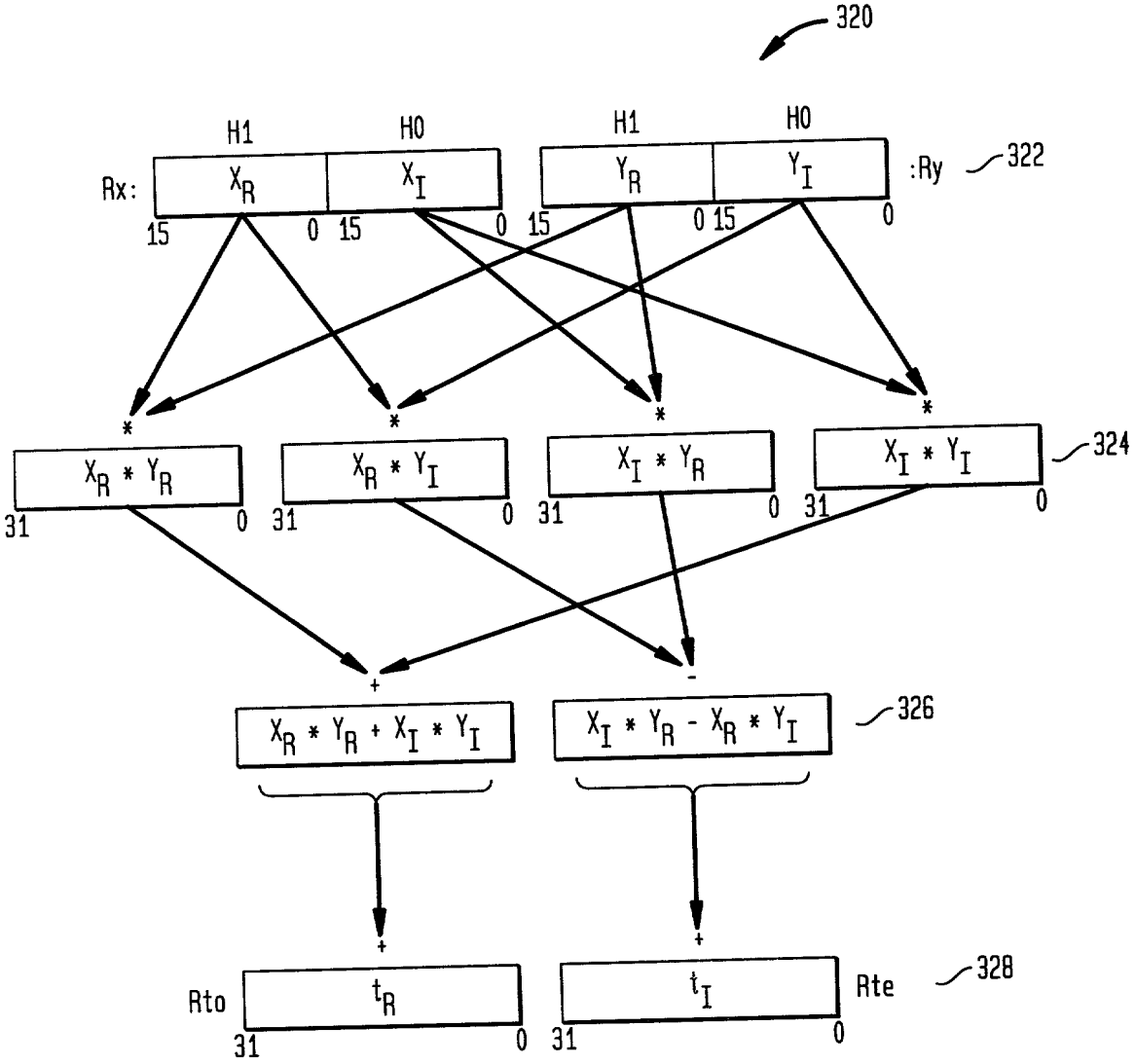
320
H1
H0
H1
H0
Rx:
$X_R$
$X_I$
$Y_R$
$Y_I$
:Ry
322
15
0
15
0
15
0
15
0
*
*
*
*
$X_R * Y_R$
$X_R * Y_I$
$X_I * Y_R$
$X_I * Y_I$
324
31
0
31
0
31
0
31
0
+
-
$X_R * Y_R + X_I * Y_I$
$X_I * Y_R - X_R * Y_I$
326
+
+
Rto
$t_R$
$t_I$
Rte
328
31
0
31
0

FIG. 4A

400

ENCODING

| 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GROUP | | S/P | UNIT | | MAUopcode | | | | | | Rte | | | | 0 | Rx | | | | | Ry | | | | | CE3 | | | ME | | | |

FIG. 4B

410

SYNTAX/OPERATION

| INSTRUCTION | OPERANDS | OPERATION | ACF |
|---|---|---|---|
| | | | DUAL HALFWORDS |
| MPYCXLA.[SP]M.2SH | Rte, Rx, Ry | DO OPERATION BELOW BUT DO NOT AFFECT ACFs | NONE |
| MPYCXLA.[NVZ].[SP]M.2SH | Rte, Rx, Ry | Rto←Rto+(Rx.H1*Ry.H1-Rx.H0*Ry.H0)<br>Rte←Rte+(Rx.H1*Ry.H0+Rx.H0*Ry.H1) | F1<br>F0 |
| [TF].MPYCXLA.[SP]M.2SH | Rte, Rx, Ry | DO OPERATION ONLY IF T/F CONDITION IS SATISFIED IN ACFs | NONE |

ARITHMETIC SCALAR FLAGS AFFECTED (ON THE LEAST SIGNIFICANT OPERAND (Rte))
C = NOT AFFECTED
N = MSB OF RESULT
V = 1 IF AN INTEGER OVERFLOW OCCURS ON EITHER RESULT, 0 OTHERWISE
Z = 1 IF A ZERO RESULT IS GENERATED, 0 OTHERWISE
CYCLES: 2

FIG. 4C

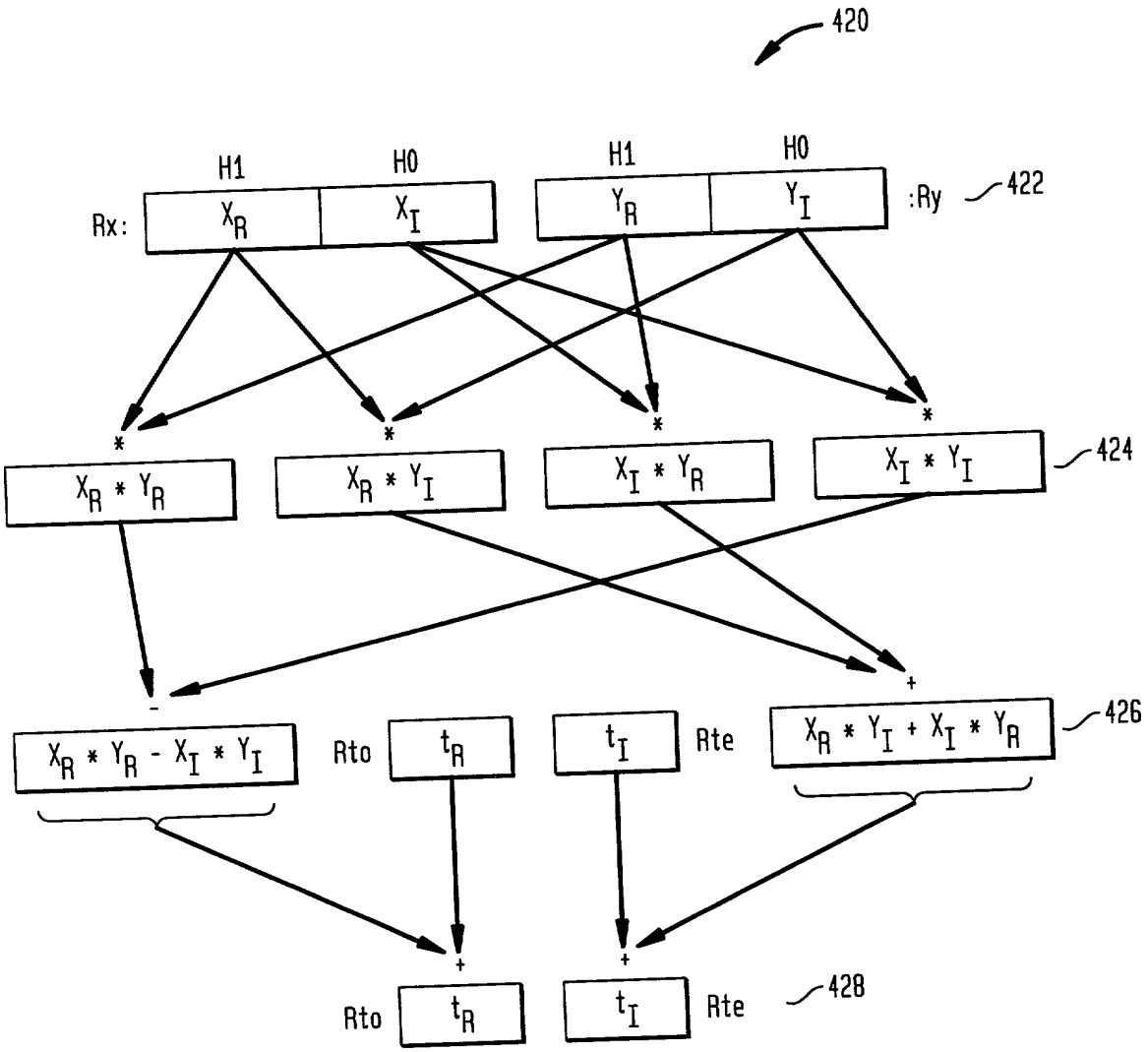
420
H1
H0
H1
H0
Rx:
$X_R$
$X_I$
$Y_R$
$Y_I$
:Ry
422
$X_R * Y_R$
$X_R * Y_I$
$X_I * Y_R$
$X_I * Y_I$
424
$X_R * Y_R - X_I * Y_I$
Rto
$t_R$
$t_I$
Rte
$X_R * Y_I + X_I * Y_R$
426
Rto
$t_R$
$t_I$
Rte
428

FIG. 5A

500

ENCODING

| 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GROUP | | S/P | UNIT | | MAUopcode | | | | | | Rte | | | | 0 | Rx | | | | | Ry | | | | | CE3 | | ME | | | | |

FIG. 5B

510

SYNTAX/OPERATION

| INSTRUCTION | OPERANDS | OPERATION | ACF |
|---|---|---|---|
| | | | DUAL HALFWORDS |
| MPYCXJLA.[SP]M.2SH | Rte, Rx, Ry | DO OPERATION BELOW BUT DO NOT AFFECT ACFs | NONE |
| MPYCXJLA.[NVZ].[SP]M.2SH | Rte, Rx, Ry | Rto←Rto+(Rx.H1*Ry.H1+Rx.H0*Ry.H0)<br>Rte←Rte+(Rx.H0*Ry.H1-Rx.H1*Ry.H0) | F1<br>F0 |
| [TF].MPYCXJLA.[SP]M.2SH | Rte, Rx, Ry | DO OPERATION ONLY IF T/F CONDITION IS SATISFIED IN ACFs | NONE |

ARITHMETIC SCALAR FLAGS AFFECTED (ON THE LEAST SIGNIFICANT OPERAND (Rte))
C = NOT AFFECTED
N = MSB OF RESULT
V = 1 IF AN INTEGER OVERFLOW OCCURS ON EITHER RESULT, 0 OTHERWISE
Z = 1 IF A ZERO RESULT IS GENERATED, 0 OTHERWISE
CYCLES: 2

FIG. 5C

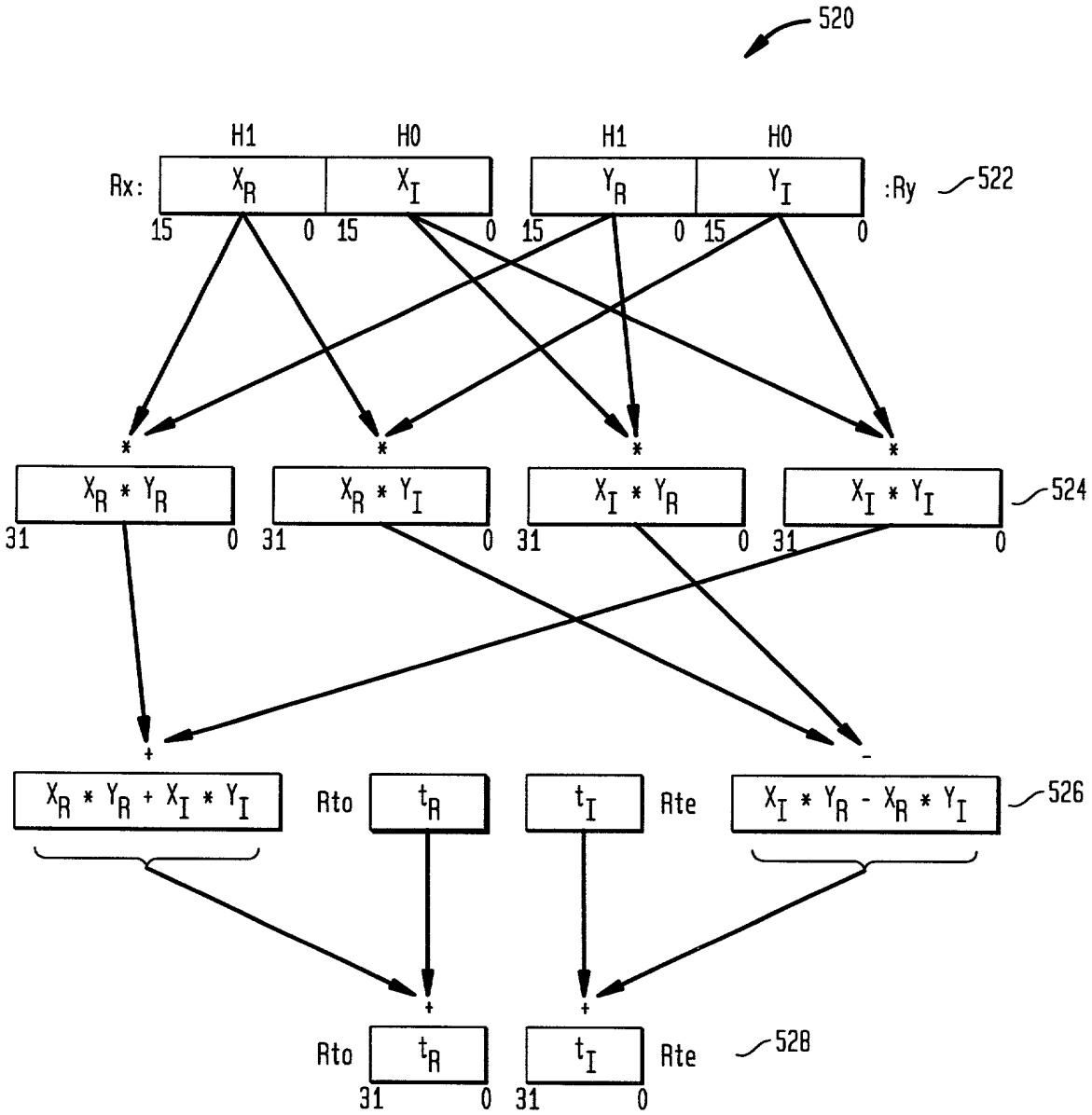
520
H1
H0
H1
H0
Rx:
$X_R$
$X_I$
$Y_R$
$Y_I$
:Ry
522
15
0
15
0
15
0
15
0
*
*
*
*
$X_R * Y_R$
$X_R * Y_I$
$X_I * Y_R$
$X_I * Y_I$
524
31
0
31
0
31
0
31
0
+
-
$X_R * Y_R + X_I * Y_I$
Rto
$t_R$
$t_I$
Rte
$X_I * Y_R - X_R * Y_I$
526
+
+
Rto
$t_R$
$t_I$
Rte
528
31
0
31
0

*FIG. 6C*

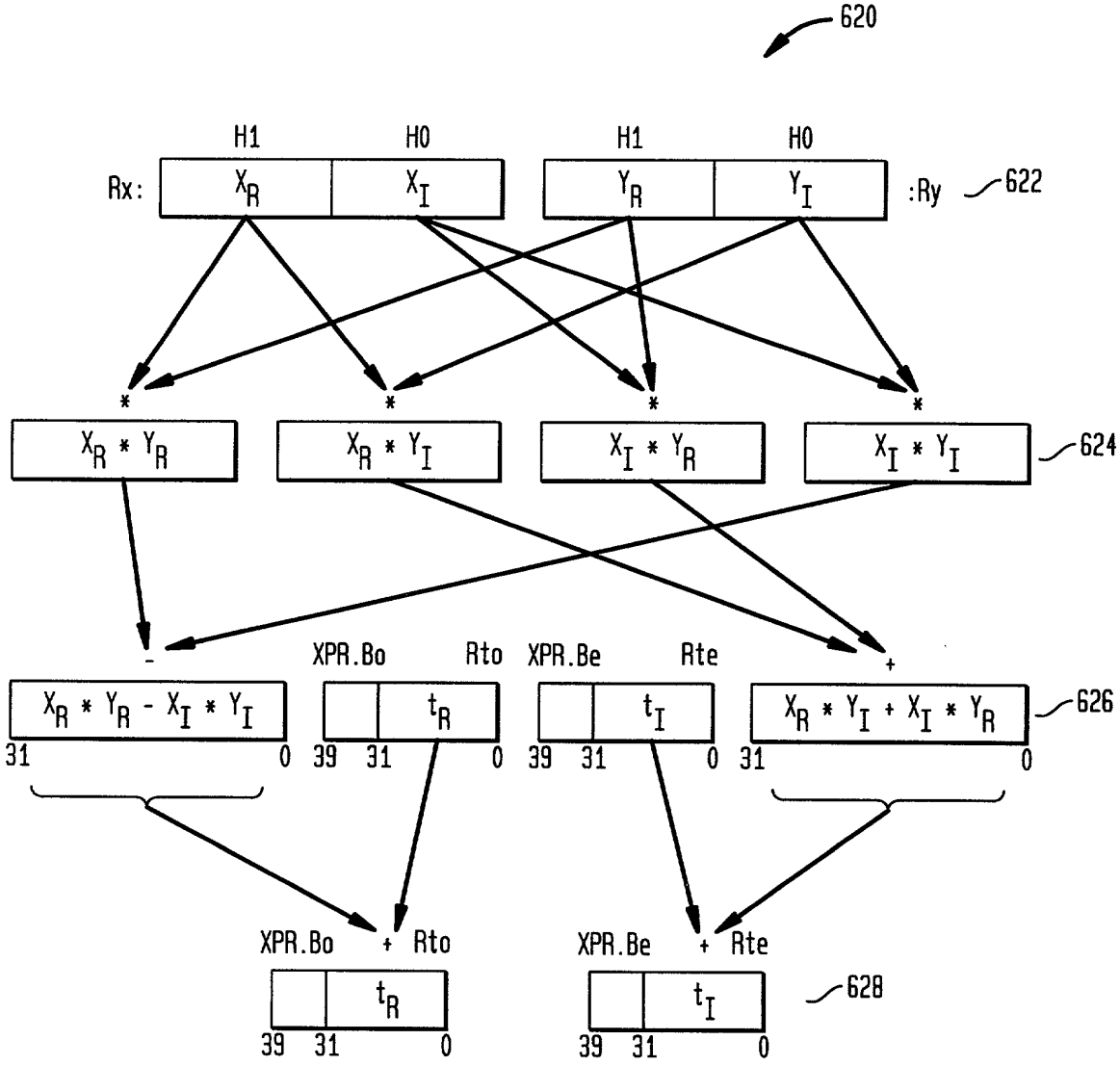
620
H1
H0
H1
H0
Rx:
$X_R$
$X_I$
$Y_R$
$Y_I$
:Ry
622
$X_R * Y_R$
$X_R * Y_I$
$X_I * Y_R$
$X_I * Y_I$
624
XPR.Bo
Rto
XPR.Be
Rte
$X_R * Y_R - X_I * Y_I$
$t_R$
$t_I$
$X_R * Y_I + X_I * Y_R$
626
31
0
39
31
0
XPR.Bo
Rto
XPR.Be
Rte
$t_R$
$t_I$
628

*FIG. 7C*

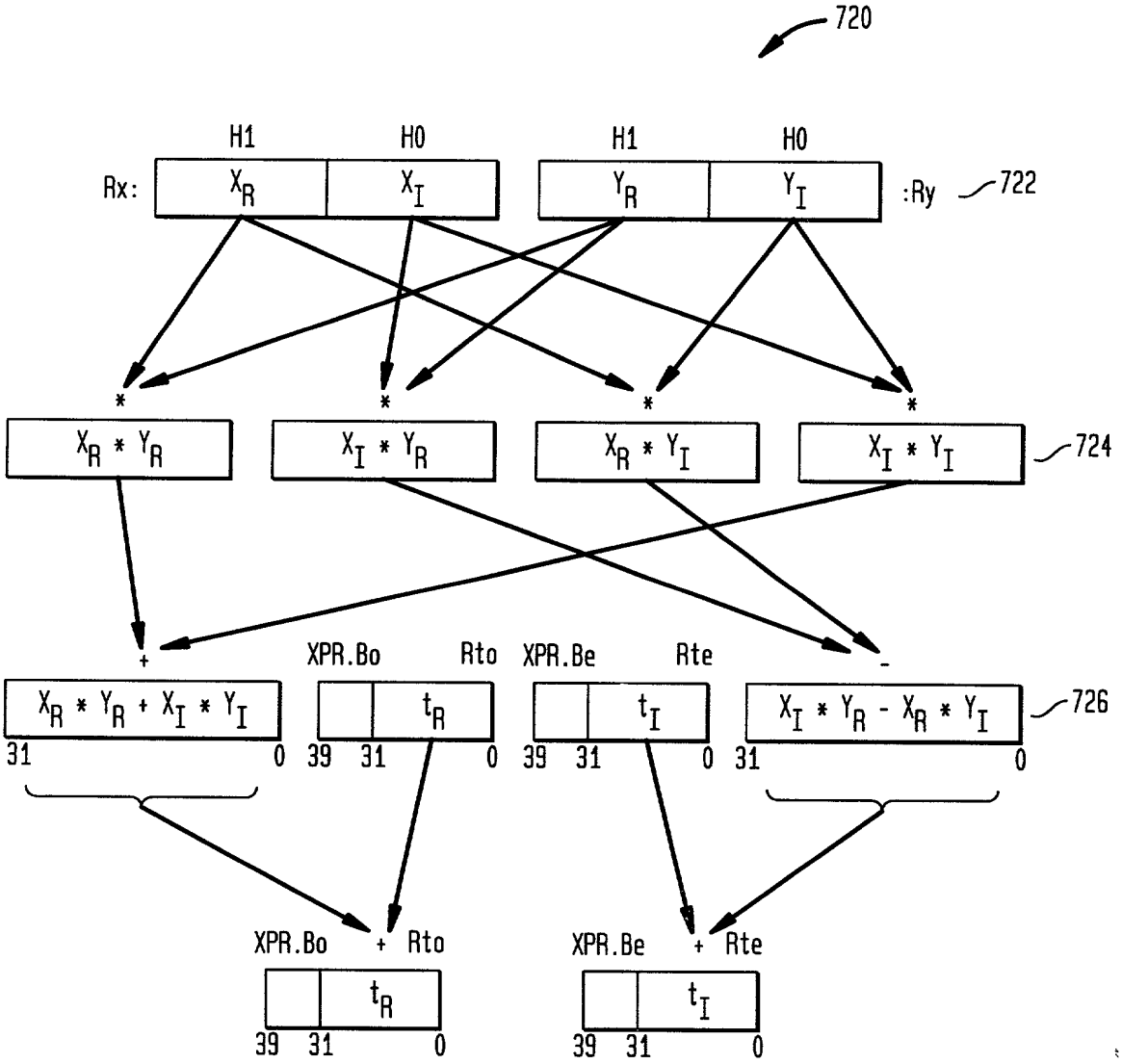
720
H1
H0
H1
H0
Rx:
$X_R$
$X_I$
$Y_R$
$Y_I$
:Ry
722
$X_R * Y_R$
$X_I * Y_R$
$X_R * Y_I$
$X_I * Y_I$
724
+
-
XPR.Bo
Rto
XPR.Be
Rte
$X_R * Y_R + X_I * Y_I$
$t_R$
$t_I$
$X_I * Y_R - X_R * Y_I$
726
31
0
39
31
0
XPR.Bo
+
Rto
XPR.Be
+
Rte
$t_R$
$t_I$

FIG. 8

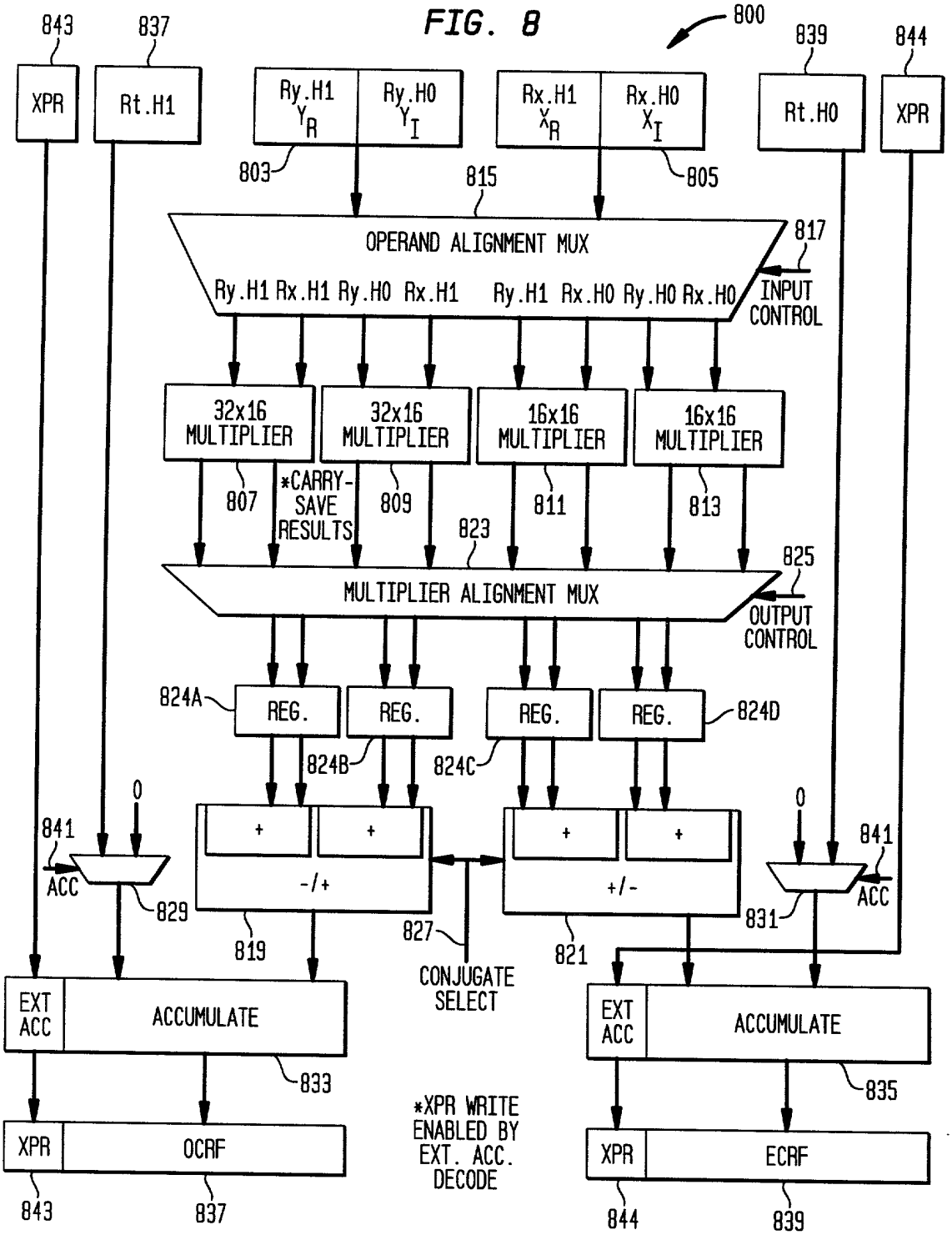
800
843
837
839
844
XPR
Rt.H1
Ry.H1 $Y_R$
Ry.H0 $Y_I$
Rx.H1 $X_R$
Rx.H0 $X_I$
Rt.H0
XPR
803
805
815
OPERAND ALIGNMENT MUX
817
Ry.H1 Rx.H1 Ry.H0 Rx.H1
Ry.H1 Rx.H0 Ry.H0 Rx.H0
INPUT CONTROL
32x16 MULTIPLIER
32x16 MULTIPLIER
16x16 MULTIPLIER
16x16 MULTIPLIER
807
*CARRY-SAVE RESULTS
809
811
813
823
825
MULTIPLIER ALIGNMENT MUX
OUTPUT CONTROL
824A
REG.
REG.
REG.
REG.
824D
824B
824C
0
841
ACC
829
+
+
-/+
819
827
CONJUGATE SELECT
+
+
+/-
821
0
841
ACC
831
EXT ACC
ACCUMULATE
833
EXT ACC
ACCUMULATE
835
XPR
OCRF
843
837
*XPR WRITE ENABLED BY EXT. ACC. DECODE
XPR
ECRF
844
839

FIG. 9

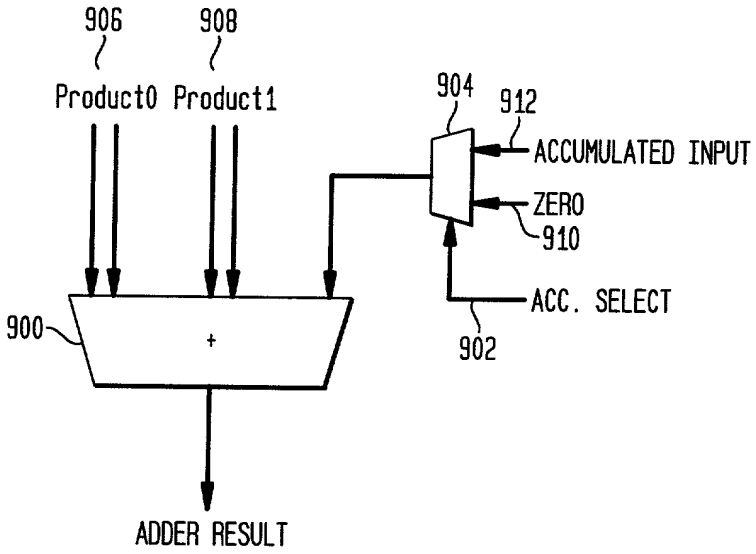
906
908
Product0
Product1
904
912
ACCUMULATED INPUT
ZERO
910
ACC. SELECT
902
900
+
ADDER RESULT

*FIG. 10*

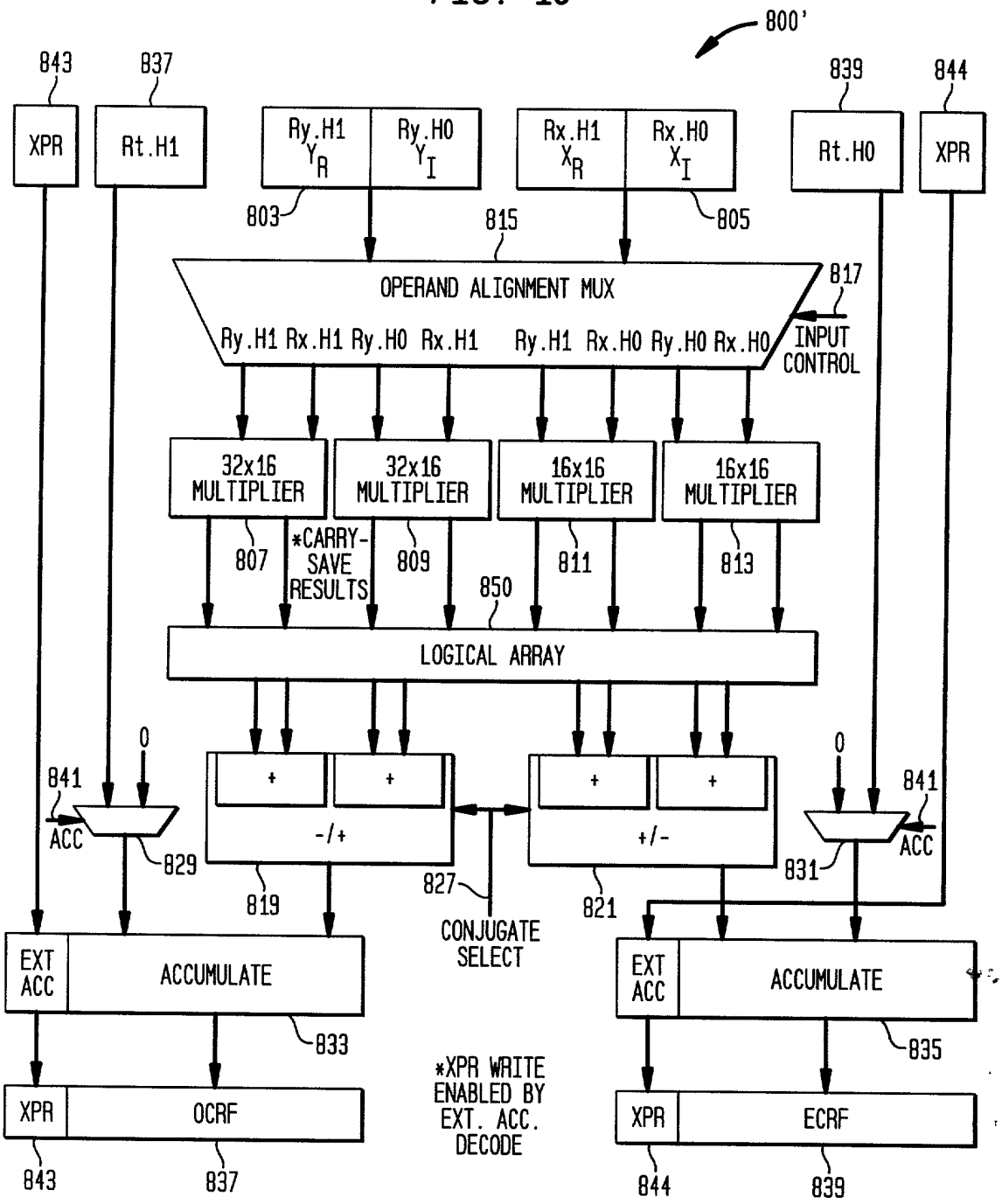
800'
843
837
839
844
XPR
Rt.H1
Ry.H1 $Y_R$
Ry.H0 $Y_I$
Rx.H1 $X_R$
Rx.H0 $X_I$
Rt.H0
XPR
803
805
815
OPERAND ALIGNMENT MUX
817
Ry.H1 Rx.H1 Ry.H0 Rx.H1 Ry.H1 Rx.H0 Ry.H0 Rx.H0
INPUT CONTROL
32x16 MULTIPLIER
32x16 MULTIPLIER
16x16 MULTIPLIER
16x16 MULTIPLIER
807
*CARRY-SAVE RESULTS
809
811
813
850
LOGICAL ARRAY
0
841
ACC
829
+
+
-/+
+
+
+/-
0
841
ACC
831
819
827
821
CONJUGATE SELECT
EXT ACC
ACCUMULATE
833
EXT ACC
ACCUMULATE
835
XPR
OCRF
XPR
ECRF
*XPR WRITE ENABLED BY EXT. ACC. DECODE
843
837
844
839

FIG. 11A

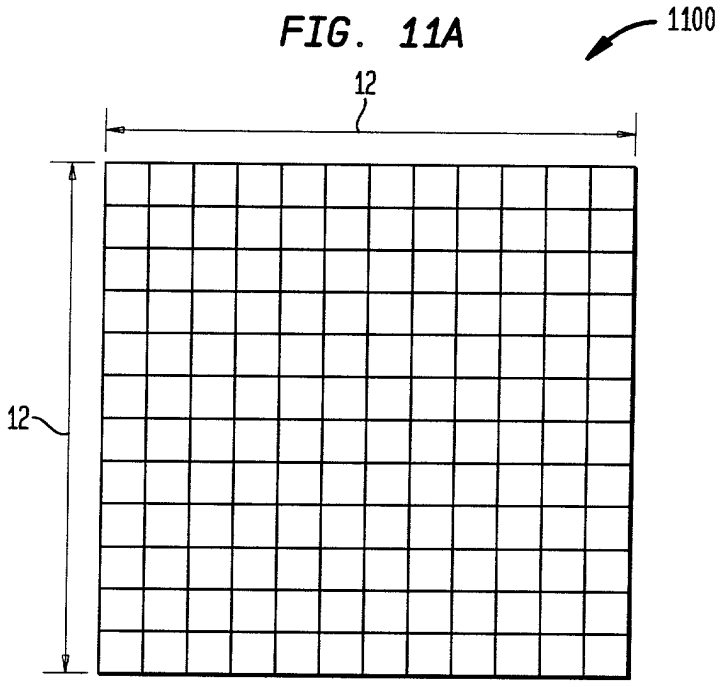


FIG. 11B

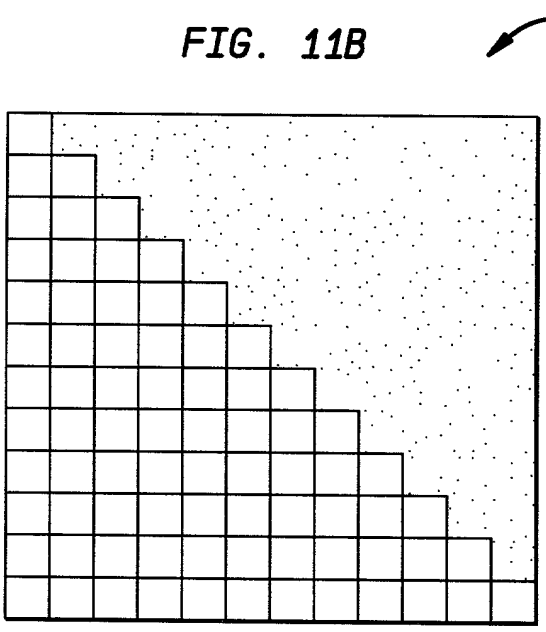

FIG. 11C

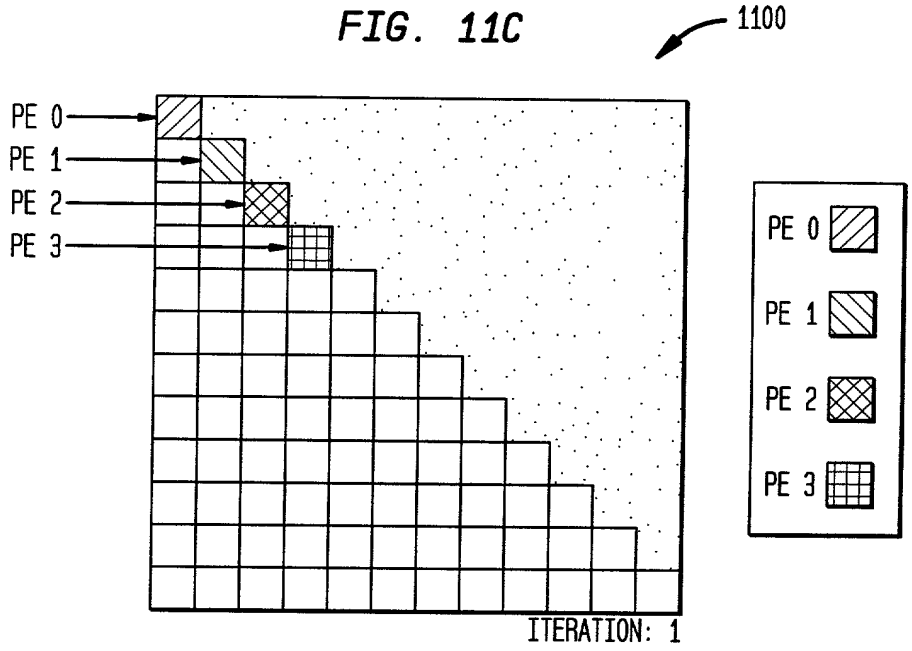


FIG. 11D

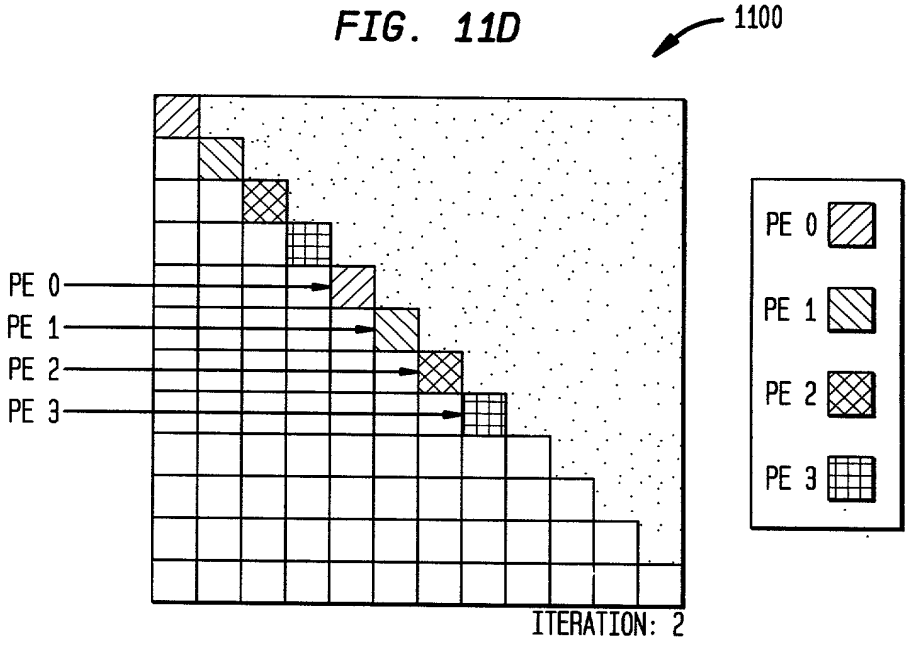

FIG. 11E

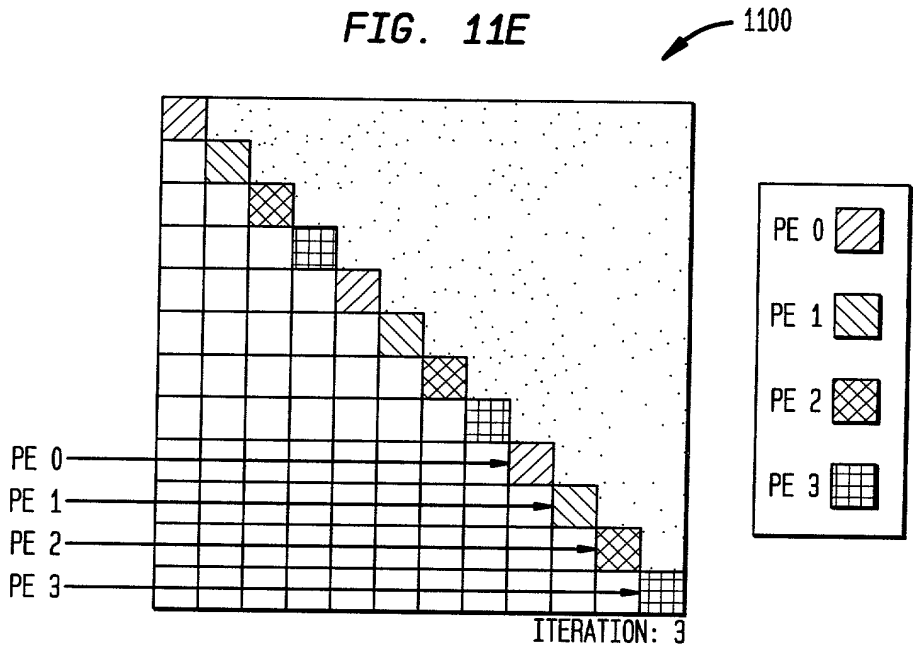


FIG. 11F

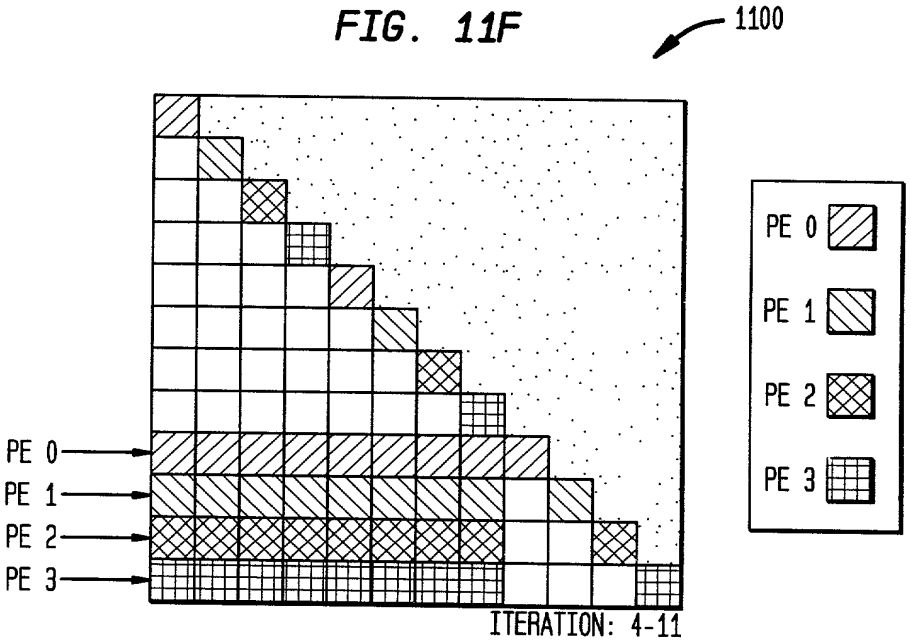

FIG. 11G

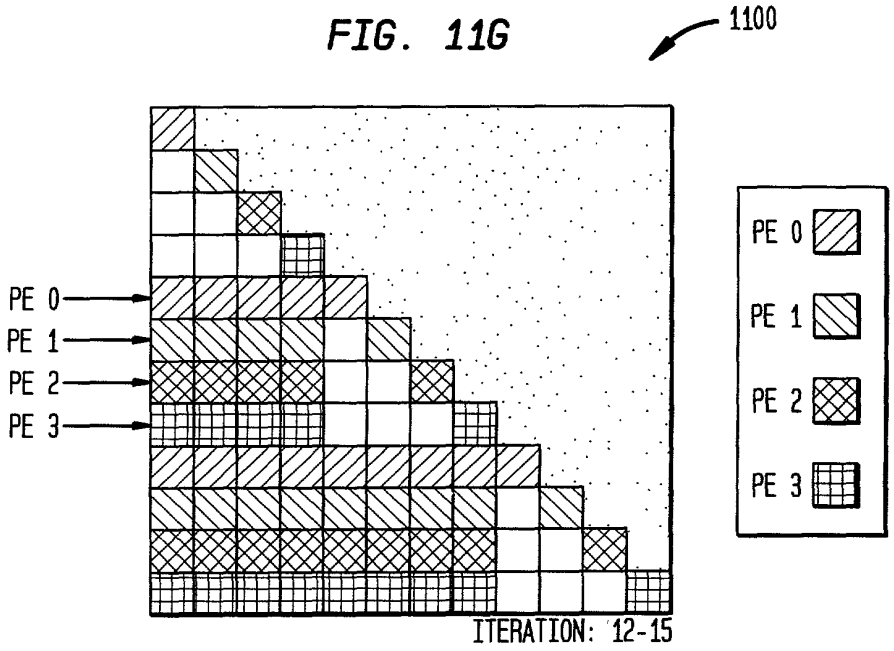


FIG. 11H

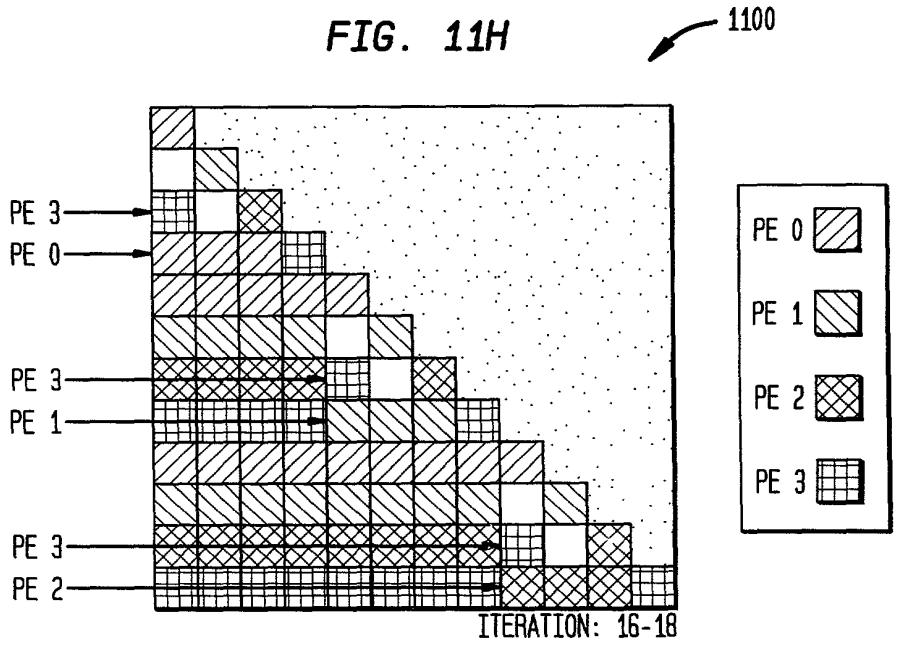

FIG. 11I